Strongest Beam

This activity is based on the *Designing and Building File-Folder Bridges* material developed by Stephen J. Ressler, P.E., Ph.D for the United States Military Academy. The full materials are available at <http://bridgecontest.usma.edu/manual.htm>. For some background information, watch the first 90 seconds of the video *Structural Engineering* from the Future Channels web site (<http://www.thefutureschannel.com/dockets/algebra/structural_engineering/>).

In this activity, you will build a beam that could be used in the construction of a bridge. One of the most important characteristics affecting the strength of the beam is the cross-sectional shape. Your challenge is to build the strongest beam using the least amount of material. Some possible shapes you might use are a rectangular bar, a hollow tube, or an I-beam. Once you have tested several designs, you will construct and enter a beam for competition with other groups.

Objectives

In this activity, you will

1. Determine the compression strength of a beam.
2. Explore how the shape of a beam affects it compression strength.
3. Use software tools to control sensor readings and graphs.

MATERIALS

|  |  |
| --- | --- |
| 3 x 5 ruled index cards | ruler |
| glue stick | scissors or hobby shop knife |

PROCEDURE

1. Design Phase

Construct various beams using a single 3 x 5 index card. The length of the beam must be 3 inches long. Experiment with various shaped beams with the desired goal to produce the strongest beam using the least amount of material. For hints on cutting and gluing your beams, see pages 20 – 23 of the *Design and Building File-Folder Bridges* Learning Activity 1 (<http://bridgecontest.usma.edu/pdfs/la1.pdf>).

Trial 1

|  |  |
| --- | --- |
| Cross-Sectional  Sketch of your beam: |  |
| **Instructions to build**  **your beam:** |  |
| **Observations:** |  |

Trial 2

|  |  |
| --- | --- |
| Cross-Sectional  Sketch of your beam: |  |
| **Instructions to build**  **your beam:** |  |
| **Observations:** |  |

Trial 3

|  |  |
| --- | --- |
| Cross-Sectional  Sketch of your beam: |  |
| **Instructions to build**  **your beam:** |  |
| **Observations:** |  |

Trial 4

|  |  |
| --- | --- |
| Cross-Sectional  Sketch of your beam: |  |
| **Instructions to build**  **your beam:** |  |
| **Observations:** |  |

Trial 5

|  |  |
| --- | --- |
| Cross-Sectional  Sketch of your beam: |  |
| **Instructions to build**  **your beam:** |  |
| **Observations:** |  |

2. Competition Phase

Once you have completed design of your beam, create one beam for competition with other groups. Record the results of your competition below.

|  |  |
| --- | --- |
| Cross-Sectional  Sketch of your beam: |  |
| Mass of your beam: |  |
| Maximum  Compression Force: |  |
| **Instructions to build**  **your beam:** |  |

Extionsions

Investigate other variables that might affect the strength of your beam

* types and thickness of paper
* glue
* beam length